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EXAMINER

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 19

Application Number: 09/362,504
Filing Date: July 27, 1999
Appellants: Kramadhathi V. Ravi et al

MAILED

MAY 29 2001

Chung-Pok Leung
For Appellant

GROUP 1700

EXAMINER'S ANSWER

This is in response to appellant's brief on appeal filed April 23, 2001.

(1) *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

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A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct. Regarding the rejections to independent claim 17 and accompanying dependent claims 28 and 30 where claim 28 depends from 30, it is noted that Matsuura is added in the claim 30 rejection yet left out in the claim 28 rejection. This typographical error is believed not to impact the interpretation of the rejections in light of the claimed invention. Specifically, the claims 17, 18, 25-28, 32-34 rejection should have Matsuura (U.S.Pat. 5,319,247) in addition to Ye et al (U.S. Pat. 5,710,486) Jin Onuki et al, Boys et al (U.S.Pat. 4,500,408), and Ramarotafika et al.

(4) *Status of Amendments After Final*

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

Regarding the interpretation of the "agreement" that was reached during the telephonic interview of August 9, 2000 concerning claim 16 - There was apparently confusion or miscommunication on over the language that was "agreed" upon during the interview. Consideration is accorded the preliminary amendment (paper 12D) to claim 16 filed jointly with the CPA on August 25, 2000 in which "sputtering" is inserted at different locations in the claim.

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The reference used to affix a 35 U.S.C. 102(b) rejection since opening examination on the first action on the merits on November 22, 1999 to Jin Onuki et al is Titled:

“High-reliability interconnection formation by a two-step switching bias sputtering process”

Clearly, the added limitation of “sputtering” to the claims could not overcome the Jin Onuki et al reference.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct. The invention may also be described as an apparatus for PECVD (plasma enhanced chemical vapor deposition) where the power sources (32, 36, 50; Figure 1) that impart electrical energy to the reactor (10; Figure 1) and the respective electrodes (24, 26, 44; Figure 1) in and on the reactor are electrically connected to each other by switches (38, 34, 52; Figure 1). The status (on/off) of these switches are then controlled in a manner to achieve the desired outcome.

(6) *Issues*

The appellant's statement of the issues in the brief is correct.

(7) *Grouping of Claims*

Appellant's brief includes a statement that claims 16-36 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8). The following grouping of claims, as stated in appellant's brief, is agreed upon by the Examiner:

Group 1 - Claim 16

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Group 2 - Claims 17, 25-28, and 30

Group 3 - Claim 18

Group 4 - Claims 19, 29, and 31

Group 5 - Claims 20-22

Group 6 - Claim 23

Group 7 - Claim 24

Group 8 - Claim 36

Group 9 - Claims 32-34

Group 10 - Claim 35

(8) *Claims Appealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) *Prior Art of Record*

The following is a listing of the prior art of record relied upon in the rejection of claims under appeal.

4,500,408	Boys et al	2-1985
5,710,486	Ye et al	1-1998
5,319,247	Matsura	6-1994

Jin Onuki et al, "High-reliability interconnection formation by a two-step switching bias sputtering process." Thin Solid Films vol. 266, Jun. 16, 1995), pp. 182-188

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H. Ramarotafika et al, "Influence of a d.c. substrate bias on the resistivity, composition, crystalline size and microstrain of WTI and WTi-N films", Thin Solid Films, vol. 266, (Jun. 1, 1995), pp. 267-273

(10) *Grounds of Rejection*

The following ground(s) of rejection are applicable to the appealed claims:

Claim 16 is rejected under 35 U.S.C. 102(b). This rejection is set forth in prior Office action, Paper No. 13.

Claims 17, 18, 25-28, 32-34 are rejected under 35 U.S.C. 103(a). This rejection is set forth in prior Office action, Paper No. 13.

Claims 19-24, 29-31, 35, and 36 are rejected under 35 U.S.C. 103(a). This rejection is set forth in prior Office action, Paper No. 13.

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(11) Response to Arguments

Group 1

Regarding "Onuki et al, however, specifically discloses terminating the sputtering power during application of the bias voltage." - In addition to Onuki et al showing "terminating the sputtering power during application of the bias voltage." as shown in Figures 1(b), Onuki et al also teaches:

- sputtering power with no bias voltage or "Conventional DC Sputtering" and...
- sputtering power with bias voltage or "Conventional DC Bias Sputtering"

Each sputtering technique is shown in Figure 1(a) and described in section 2.1

With regards to the position where "Fig. 1b clearly shows no overlap between the bias voltage and the sputtering power." - A full appreciation of the physics of Figure 1(b) supports the fact that electrical circuits cannot reproduce exact square wave forms due to a required finite time to charge and discharge the circuitry. As such the rises and drop-offs of the "square" wave-forms of Figure 1(b) are not completely vertical with infinite slope, these drop-offs must, in reality, have largely positive (rises) or largely negative (drop-offs) slopes less than infinity.

Regarding the multiple cycles described in Figure 1(b) with each depositing sequential layers - the added insight of Figure 1(b), described above, implicitly demonstrates overlap between the bias voltage and the sputtering power.

Jin Onuki et al also implies cross-box relationships such as is shown in "2-Step Switching Bias

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Sputtering" where three boxes with 18, 3, and 1 cycle is shown as a grouped procedure. Jin Onuki et al also shows "Conventional Sputtering" where two boxes are shown as grouped, or having a common time axis.

With regards to Jin Onuki et al not teaching "a reduced stress layer for reducing the stress of films deposited on the substrate" - Claim 16 (Group 1) does not have remotely similar text in its body.

Claims 16 and 23 are product - by - process type claims. In the examination of the application, no patentable weight was accorded the process limitations because a product defined by the process by which it can be made is still a product claim (In re Bridgeford , 149 USPQ 55 (CCPA 1966)) and, in accordance with restriction practice, if the examiner can demonstrate that the product as claimed can be made by another materially different process such as conventional sputtering (Jin Onuki et al - Figure 1a) vs. Switching bias sputtering (Jin Onuki et al - Figure 1b); defining the product in terms of a process by which it is made is nothing more than a permissible technique that applicant may use to define the invention.

Group 2

The Group 2 arguments reproduce the same arguments from Group 1 and add:

Alleged impermissible hindsight:

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In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

References not related:

In response to applicant's argument that the cited references are nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, the cited references in the field of applicant's endeavor or, specifically, thin film applications mediated through plasma enhanced CVD.

No suggestion to combine:

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion,

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or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, obviousness is, in the Examiner's opinion, established in all actions by the combining or modifying the teachings of the prior art to produce the claimed invention where there teaching, suggestion, and motivation to do so was found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art.

Group 3

The Group 3 arguments reproduce the same arguments from Group 2. In addition - Program instructions for "depositing a plurality of the first layers and second layers until the desired thickness of the film is reached ." is taught by Boys et al (column 11, lines 40-59; column 12, lines 20-48).

Group 4

The Group 4 arguments reproduce the same arguments from Group 3.

Group 5

The Group 5 arguments reproduce the same arguments from Group 4. In addition - A controller (item 57; Figure 1) with program instructions for "depositing a first layer by sputtering." is taught by Boys et al (column 12, lines 20-34; column 4, lines 3-7).

Alleged impermissible hindsight:

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In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Group 6

With regards to claim 23 and the position that "the references do not teach or suggest an insulating layer formed between the metal layer and the semiconductor substrate and including a first silicon oxide layer and a second silicon oxide layer deposited using a high density plasma chemical vapor deposition process" -

It is precisely taught by Onuki et al that, according to section 2.1: "The 0.5 μm thick Al-0.5wt.%Cu-1wt.%Si films were deposited onto Si wafers with a 0.5 μm thermally grown SiO_2 layer by conventional....". Thus, Onuki et al deposit an insulating layer of silica, as a "silicon oxide layer", atop a Si (semiconductor) substrate with an overlying layer containing metallic components. This is precisely depicted in figure 4 and associated discussions.

With regards as to the *cause* of the deposition of the "first silicon oxide layer for the reduction of mechanical stress" as stated in prior actions on the merits:

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“It would have been obvious to one of ordinary skill in the art at the time the invention was made to consider application of the Matsuura method, in the Ye et al apparatus, for forming silicon and oxygen combined thin films for “superior crack resistance and insulation” (silicate, column 6, lines 4-11) by optionally (embodiment) applying silane and oxygen gases (column 7, line 67; claim 1).

Motivation for combining the above references follows from the Matsuura identified improved substrate rigidity, or reducing mechanical stress, and electrical isolation as for “superior crack resistance and insulation” (silicate, column 6, lines 4-11).” That applicant may have had a slightly different reason for inclusion of the oxide layer is immaterial.

Thus, either alone or in combination, the limitations of claim 23 (Group 6) are either inherent in the teachings of Onuki et al as described with reference to MPEP 2112.02 or, at minimal, are obvious over Ye et al (U.S. Pat. 5,710,486) in view of Jin Onuki et al, Boys et al (U.S.Pat. 4,500,408), Ramarotafika et al, and further in view of Matsuura (U.S.Pat. 5,319,247).

See group 1 above concerning product - by - process claims.

Group 7

The Group 7 arguments reproduce the same arguments from Group 6 and adds:

“...a second metal layer is formed above the substrate and below the at least one insulating layer, and a second insulating layer is formed between the second metal layer and the substrate.”

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Jin Onuki et al precisely teach the location of material strata with respect to the claimed process as described in sections 2.1 and 3.1 with accompanying Figures 1(a,b) and Figure 4. As discussed in prior actions, section 2.1 teaches “cycles” in switching bias sputtering as per figure 1(b) where films of the claimed invention are formed. Cycles of “conventional sputtering” of Figure 1(a) are believed inherent according to the teachings of Jin Onuki et al.

Group 8

The Group 8 arguments reproduce the same arguments from Group 6 and Group 1 and adds:

“...the first silicon oxide layer is deposited on the substrate by applying a sputtering power to reactants to generate a plasma in a process chamber, and the second silicon oxide layer is deposited on the first silicon oxide layer by biasing the plasma toward the substrate while maintaining application of the sputtering power to the reactants.”

Refer to the response to the group 1 and 6 arguments above.

Group 9

The Group 9 arguments reproduce the same arguments from Group 6 and Group 1 and adds:

“Applicants contend that the rejection based on the combination of the references benefits from the exercise of hindsight.”

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a

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sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Refer to the response to the group 1 and 6 arguments above.

Group 10

The Group 10 arguments reproduce the same arguments from Group 9 and adds:

“Matsuura merely disclose formation of silicon oxide films, and does not cure the defects of the other references. Therefore, claim 35 is patentable.”

Dependent claim 35 merely adds “The computer readable storage medium of claim 32 wherein said process gas includes flows of silicon and oxygen.” In rejecting claim 35, the Examiner does not apply the Matsuura (U.S.Pat. 5,319,247) reference to teach the claimed subject matter. It is well established that Jin Onuki et al teach “process gas includes flows of silicon and oxygen” in order to produce the stated films already described.

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It is believed that, for the above reasons, the rejections should be sustained principally because the central theme to all claims and arguments present in the application concerns the switching process that Jin Onuki et al clearly describes.

Respectfully submitted,

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May 24, 2001


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